Research Roundup

Rosettes for elongation

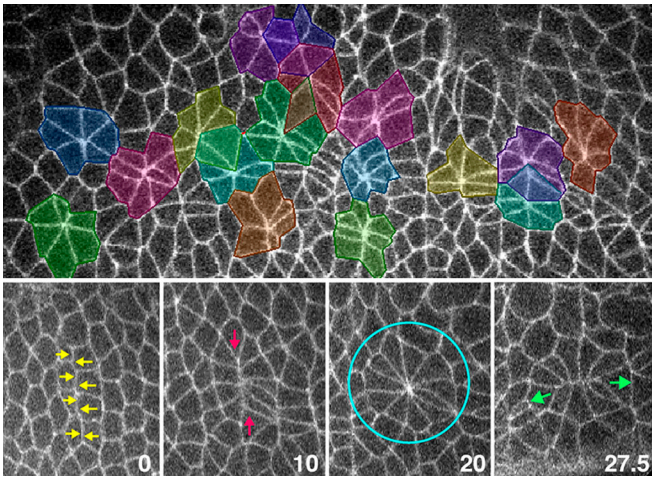
A blob becomes a body by becoming thinner and longer—a process that involves cell shuffling called intercalation. Flies do it by making and resolving rosettes of cells, say J. Todd Blankenship, Jennifer Zallen, and colleagues (Sloan-Kettering Institute, New York, NY). Up to 11 cells join these pinwheels, which squeeze together cells that were arrayed in the dorsal–ventral axis, before letting them relax back into a line running from anterior to posterior.

The rosettes are striking, but it has taken a long time for them to be identified. "I also spent a lot of time not seeing them," says Zallen. "It was making movies that made the difference—then you see they are directional. Now when I read papers I see them all the time."

In a previous model for elongation, called neighbor exchange, single-cell junctions running vertically were proposed to contract to a point, and then expand back out again horizontally. "These behaviors are happening, but we think they are only part of the story," says Zallen. "The starting order they require is not there."

But how to define "order"? Initially, says Zallen, "I didn't have a vocabulary to describe it." But with her physicist father she used quantitation methods familiar to those who study soap bubbles. Paradoxically, they found that disorder at the cellular level increased even as the tissue got closer to its elongated, more globally ordered state.

The increased disorder appears to be from rosette formation. Patterning genes drive actin then myosin accumulation at anterioposterior cell borders, and actomyosin tugging parallel to the membrane probably helps form the rosettes.

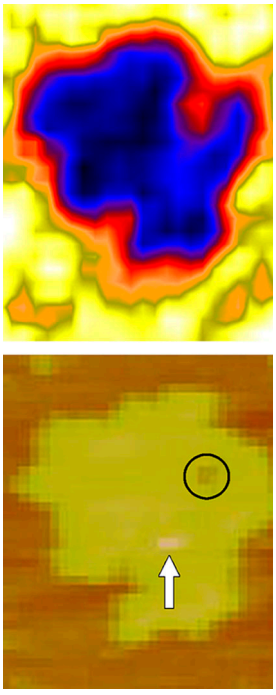


ZALLEN/ELSEVIER

Rosettes (top) form via vertical contraction then relax horizontally (bottom, left to right).

When tracked for 25 minutes of so-called germband extension, 87% of cells are transiently incorporated into one or more rosettes. This amount of rearrangement, together with neighbor exchange, can account for most of the elongation seen. The mechanism for rosette resolution is unclear; clues should come from isolating components that lie downstream of patterning genes. JCB

Reference: Blankenship, J.T., et al. 2006. *Dev. Cell.* 11:459–470.


BOXER/AAAS

Lipid domains chemically identified by SIMS (top) match images from AFM (bottom).

Lipid microscopy

A chance meeting with a cosmochemist has led Steven Boxer to a new way to precisely image lipid locations. With Mary Kraft (Stanford University, Stanford, CA) and colleagues, he hopes to test ideas generated by the raft hypothesis. "A lot of this is cartoons," says Boxer. "We want to translate these cartoons of membrane molecules into reality."

The technique fills in a gap between FRET (operating over a maximum of a few nanometers) and optical microscopy (several hundreds of nanometers or more). Now, the NanoSIMS (secondary ion mass spectrometry) machine identifies lipid distributions with a lateral resolution of ~100 nm.

The NanoSIMS sweeps a focused beam of cesium ions over the sample in around 10 minutes. The high-energy beam almost completely fragments proteins and lipids. Thus, molecules can be easily identified only if they are labeled with a particular isotope. The advantage, however, is that "we are reducing this thing to dust and we get a lot of dust per molecule," says Boxer. "So sensitivity is very high." In the future, different types of beams may allow identification without the need for labeling.

The next trick is to get access to the instrument. The 5 instruments in the US cost $2–3 million each, and are tricky to run. They are not yet bio-friendly, as their original use was the analysis of specks of dust from comets. "These instruments were the private domain of that [cosmochemist] community," says Boxer.

But he thinks they complement the alternative: atomic force microscopy (AFM), which feels the shape of the protein and lipid landscape. "AFM has no chemical information," he says, "and is notorious for confusing real signals and debris. Those are the most expensive measurements of dirt you are ever going to see."

He remains skeptical of much of the raft concept, but asserts that "there must be organizing principles of some sort." Those principles should emerge once experiments are applied not only to the current lipid mixtures made in vitro but also to membrane samples isolated from cells. JCB

Reference: Kraft, M.L., et al. 2006. *Science.* 313:1948–1951.